

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11)

Publication number:

0 230 364
A2

(12)

EUROPEAN PATENT APPLICATION

(21)

Application number: 87300246.3

(51)

Int. Cl.: B 05 D 1/00, B 44 C 1/17,
B 44 C 3/08

(22)

Date of filing: 13.01.87

(30)

Priority: 14.01.86 US 818795

(71)

Applicant: MINNESOTA MINING AND MANUFACTURING
COMPANY, 3M Center, P.O. Box 33427, St. Paul,
Minnesota 55133-3427 (US)

(43)

Date of publication of application: 29.07.87
Bulletin 87/31

(72)

Inventor: Johnson, Bruce E. c/o Minnesota Mining and
Manufacturing Co. 2501 Hudson Road P.O. Box 33427,
St. Paul Minnesota 55133-3427 (US)
Inventor: Naglosky III, Max c/o Minnesota Mining and
Manufacturing Co. 2501 Hudson Road P.O. Box 33427,
St. Paul Minnesota 55133-3427 (US)

(64)

Designated Contracting States: BE DE ES FR GB IT NL
SE

(74)

Representative: Baillie, Iain Cameron et al, c/o Ladas &
Parry Isartorplatz 5, D-8000 München 2 (DE)

(54)

Composite useful for paint transfer and method of use and preparation thereof.

(57)

A paint transfer composite useful in forming a protective coating on a compound structural component is provided. The composite is preferably vacuum thermoformable and is comprised of an optional carrier liner sequentially covered with continuous layer of an optional clear coating, a pigmented base coating and a heat-activatable adhesive wherein the adhesive has a sufficiently low glass transition temperature and a sufficiently high tensile modulus to resist damage to said adhesive layer on impact. A method of paint transfer using the composite and a method of preparing the composite are also provided.

EP 0 230 364 A2

0230364

PATENT
F.N. 40438 USA 9A

COMPOSITE USEFUL FOR PAINT TRANSFER
AND METHODS OF USE AND PREPARATION THEREOF

Field of the Invention

This invention relates to a paint transfer
5 article which may be used to apply a coating to a
substrate. More particularly, this invention relates to a
paint/adhesive composite which allows for the transfer of a
paint coating to the surface of a component such as the
exterior surface of an automobile body panel.

10

Background of the Invention

Many articles of manufacture have structural
components, the exterior surfaces of which define a
compound surface, for example, automobile door panels,
fenders, hoods, and the like. The exterior surfaces of
15 these compound structural components have been painted by
various techniques in order to apply a protective and
decorative coating thereto. There have been improvements
made in the paints and in the application equipment, yet
the basic features of the commercially used processes
20 remain essentially unchanged. In general, a paint is
reduced to a satisfactory viscosity with solvents, and is
then applied or propelled onto the surface of the end
product. Solvent is then allowed to evaporate into the air
at point of application and also in bake ovens used to cure
25 or dry the paint. The pollution resulting from the
evaporation of the volatile organic compounds used as paint
solvents has led to the use of expensive solvent collectors
and after burners to reduce this pollution.

30

The paint industry has developed coatings that
have reduced solvent content, but they still do not meet
many environmental, performance or economic requirements.
Electrostatic application devices have been designed to
develop high transfer efficiencies, however, the solvent

0230364

has to be discharged in ovens, if not the spray booth.

British Patent No. 1,444,748 describes a process of applying a decal to a contoured ceramic surface wherein heat is applied to activate the adhesive. This process
5 requires perforation in the critical layer.

U.S. Patent No. 3,813,823, entitled "Heated Vacuum Pressure Press", describes a transfer process for printed circuitry. A conventional heat-vacuum applicator is modified with the added dimension of air pressure, the
10 pressure being exerted above the diaphragm that holds the work on the vacuum platen. This provides more positive contact such that the printed circuitry is transferred in greater detail from the workpiece to a flexible film. This patent thus describes an on-contact vacuum-pressure-heat
15 cycle that is applicable to essentially flat surfaces.

Heat-vacuum application of decals, woodgrain prints, signing, etc. has been common practice in the art. The conventional practice involves the contact placing of a film article, coated with a heat activatable adhesive, onto
20 an application surface. It is the accepted practice to perforate the adhesive coated film to provide release of entrapped air. The work piece is covered with a rubber diaphragm that is hinge mounted on a vacuum platen. The vacuum forces the film into intimate contact with the
25 application product surface and air escapes through the perforations as the film product spreads out evenly on the surface, with the cool adhesive still in a non-tacky state. Heat is then applied to activate the adhesive and cause bonding. This application procedure is satisfactory for
30 application to flat or mildly contoured surfaces, provided that the adhesive coated film can stretch around the contours while the adhesive is in a relatively tack-free state, and provided that air has been removed through perforations in the substrate. The heat to activate the
35 adhesive is applied only after full contact is made, otherwise bubbles and wrinkles will form. This process does not lend itself to high speed production. The vacuum

applicator must be cooled down completely prior to the insertion of the next item otherwise that item would pre-bond when the adhesive prematurely heats up.

British Patent No. 1,475,051 describes a vacuum-
5 heat process for transferring a pre-coated paint, dye, or
lacquer to a contoured shape by pneumatic means. The paint
or dye is coated on a carrier and must be in a liquid state
during the transfer. The liquid coated carrier is forced
10 into contact with the article with pneumatic differential
pressures. Contact is maintained for sufficient time to
effect transfer. Heat is then applied to remove the
solvents and cure the paint.

U.S. Patent No. 3,549,446 describes a machine and
process for applying a decal to a concave dish shaped
15 surface. The decal, which separates upper and lower
chambers of the machine, has a hole cut in the carrier
paper, close to the center, in line with a pressure source
in the upper chamber. The vacuum in the upper chamber
holds the carrier up, while the vacuum in the lower chamber
20 peels the decal down off the carrier. Pressure is exerted
through the hole in the carrier to force initial peel in
the center, causing the decal to balloon radially outward.
Initial contact is thus made at the center. Heated air is
used to activate the adhesive as it is making contact.

25 U.S. Patent No. 3,813,270 discloses a heat
transfer machine wherein a decal is transferred in a heated
press to a piece of apparel, held down on a vacuum platen.

U.S. Patent No. 4,101,698, entitled "Elastomeric
Reflective Metal Surfaces", discloses a film laminate
30 construction of a polyurethane coating on a temporary
release carrier, with a heat-activated or
pressure-sensitive adhesive. Metal vapor is deposited
between the elastomeric urethane and the adhesive to give
the coating a bright look. The laminate is forced into a
35 female cavity of a mold by the pressure of the hot
back-filling molding compound. The adhesive sets onto the
molding compound such that when the mold is opened, the

0230364

hardened compound has a urethane protected bright surface.

There have been several heat transfer applications that do not include pneumatic pressures to apply a conformable laminate:

- 5 U.S. 3,928,710 - "Heat Activated Transfers";
- DE 3028823 CR - (Heat Transfer in general);
- U.S. 3,907,974 - "Cureable Decorative Systems for Glass and Metal Containers";
- British Patent No. 2,081,645 - "Apparatus for
- 10 Applying Decals";
- U.S. 4,263,077 - "In-Press Transfer Painting of Hardboard";
- U.S. 3,679,506 - "Transfer Coating Process"; and
- German Plastics Article: On Hot Stamping:
- 15 Kunststoffe 72 (#11) 1982.

U.S. Patent No. 3,640,791, entitled "Process for Preparing and Applying an Improved Painting Device", discloses a paint transfer process for automobiles and a precoated paint, coated on a releasable carrier, that has a

20 water activatable or pressure sensitive adhesive on the paint. This is generally described as a patch.

In International Publication Number W084/03473, the title of which is "Heat Transfer Pad Decoration and Substrate Therefor", a heat transfer product for a

25 contoured surface is described. The product consists of a polyamide adhesive/release coating on a paper liner, printed with an ink and protected with a clear coat. The polyamide is referred to an adhesive/release coating because it releases from the paper when heated and acts as

30 a hot melt adhesive when in contact with a substrate. The transfer is picked up with a hot silicone sponge from the paper and pressed onto the contoured application surface. The polyamide creates a bond and the sponge then releases.

Among the problems experienced by the industry or

35 cited in the art, are:

0230364

- 1) composites that can't be applied to three dimensional contours without the bubbles and wrinkles caused by pre-adhesion;
- 2) solvent emissions at component assembly sites;
- 3) films which need to be perforated to be applied;
- 4) the necessity of holes in substrates to allow a vacuum therethrough to apply a composite; and
- 5) adhesives having poor adhesive performance under varying environmental conditions.

In summary, a need exists in the art for a paint composite that can be applied easily and inexpensively and yet will provide a durable protective coating over a range of thermal environments.

Summary of the Invention

This invention relates to a paint transfer composite article comprising:

- a) a continuous layer comprised of a heat-activatable adhesive which has a sufficiently low glass transition temperature and a sufficiently high tensile modulus to resist damage to the adhesive layer on impact and
- b) a continuous coating of dry paint on one major face of the continuous layer of adhesive.

This invention is a unique approach to overcome concerns of solvent emission at automobile assembly sites and provide a paint coating having excellent performance in use. The concept of this invention concentrates all emission at one location, i.e., the site of manufacture of the composite article, making it more economically feasible to recover the solvents because the product of this invention does not require the emission of solvents at automobile assembly plant sites, as the paint is thermally activated and bonded without further use of solvents. The properties of the heat-activated adhesive provides

0230364

excellent performance of the composite as a protective coating using standard metallic automobile body paints.

This invention also relates to a method of paint transfer comprising:

- 5 a) mounting a compound structural component in a vacuum chamber having an opening, the area of which is no smaller than the surface of the compound structural component to be painted such that the surface of the compound
10 structural component to be painted communicates therewith;
- b) sealing the opening of the vacuum chamber which communicates with the surface of the compound structural component with the paint transfer
15 composite article described above in a manner such that the heat-activatable adhesive layer communicates with the surface of the compound structural component to be painted;
- c) drawing air from vacuum chamber and exposing
20 the paint transfer composite to heat sufficient to allow the composite the vacuum thermoform onto the surface of the compound structural component but insufficient to activate the adhesive layer; and
- 25 d) then exposing the adhesive layer to heat sufficient to activate the adhesive layer; and
- e) allowing the activated adhesive to cool while
30 maintaining the vacuum used to thermoform the composite until the adhesive has cooled below its activation temperature.

When the compound structural component has severe three-dimensional contour, step d) is preferably accomplished by contacting the exposed surface of the composite with sufficient heated, forced air to form the
35 composite about the component as well as activate the adhesive.

This invention also relates to a method of preparing a paint transfer composite comprising:

- a) coating a carrier liner with a continuous coating of paint;
- 5 b) drying the paint to form a dry paint coating; and
- c) coating the exposed surface of the dry paint coating with a continuous layer of a heat-activatable adhesive which has a
- 10 sufficiently low glass transition temperature and a sufficiently high tensile modulus to resist damage to the adhesive layer on impact.

This invention further relates to a method of preparing a cold formed metal compound component comprising

15 applying a composite as described above to a substantially planar metal substrate with the heat-activatable adhesive layer in contact therewith, and cold-forming the substrate to the desired compound shape. This invention also relates to a cold-formable metal substrate comprising a

20 substantially planar metal substrate, a continuous layer of a heat-activatable adhesive which has a low glass transition temperature and a high tensile modulus on at least one surface of the metal substrate and a continuous coating of dry paint on the exposed major face of the

25 continuous layer of the adhesive. The composite of this invention can be applied to substantially coplanar metal stock, e.g., placed on the metal stock with the adhesive in contact with the metal, subjected to heat to activate the adhesive and allowed to cool to ambient temperature. The

30 covered metal stock can then be cold-formed, e.g., stamped, to form a compound component. It has been found that the use of the adhesive yields a product which can be stamped without a deleterious effect on the dry paint coating. This invention accordingly eliminates the need to form a

35 compound metal part before it is painted.

Detailed Description of the Invention

The components of this invention may be described as a carrier liner, a dry paint coating, and a heat-activatable adhesive.

5 The carrier functions as a temporary support for the coatings. It should have a specific combination of properties for optimal results. It should have:

1) chemical resistance to resist the solvents of the coatings that are metered onto its surface;

10 2) temperature resistance, to maintain dimensions and shape, up to the temperature required to dry and cure the paint;

3) uniformity in thickness, gloss and texture, because the subsequent coatings take on these features when they are peeled off;

4) physical strength to pull through a coater and oven drier, with minimal stretch or tearing; and

20 5) The appropriate surface energy to allow for uniform lay down of coatings, without non-wet spots, and uniform release of the coatings when peeled.

The carrier must possess an additional property in certain embodiments. The carrier may be used as a protective skin during thermoforming. This requires that the carrier have a softening temperature above the

25 temperature, at which the paint and adhesive coatings thereon are cured, and that it respond to thermoforming by either vacuum and/or pressure forces.

There exists a third alternative embodiment. The carrier at times may become an integral part of the final

30 thermoformed coating. This mandates high adhesion values of the coatings to the carrier, in addition to the other properties discussed in cases one and two.

Preferred carriers are polymeric films having high tensile strength. Particularly preferred are

35 polycarbonates, uniaxially oriented polypropylenes, and biaxially oriented polyethylene terephthalates, each having a thickness of from about 0.003" to about 0.005".

The dry paint coating of this invention is preferably comprised of a clear coating and a pigmented base coating. One of the advantages of this invention is the utility of a standard automobile body paint as the paint coating of the composite of this invention. Of course, a paint could be specially formulated for use in the composite of this invention, but it is not necessary to do so to obtain a composite of this invention having excellent performance of a protective coating.

The optional clear coating is used to impart an appearance of depth, and in certain cases, to protect the sub-layers from environmental erosion caused by acid rain, ultraviolet light, and general weathering. The clear coating should be formulated to:

- 1) be compatible with the chosen paint;
- 2) release or adhere to the carrier, dependent upon the type of application;

3) dry or cross-link at an energy level below that needed to thermoform the composite; and

4) elongate at the forming temperature without stress cracking or rupture, and then perform after being firmly bonded, in this state of elongation, according to the particular application requirements. Examples of suitable clear coatings include melamine modified polyurethane lacquers, such as that sold under the tradename HCC-1000 Elastomeric Enamel by PPG Industries, Inc., and two-part polyurethanes.

The cured paint coating may function as the outermost layer of the final product, but it is often protected with the above-mentioned clear coating. This base coat should be formulated to:

- 1) yield the appropriate color;
- 2) provide the correct loading of pigments, e.g., metallic pigments;

3) adhere to the clear layer or release from the carrier;

4) provide the same balance of thermal and dimensional properties as the clear; and

5) elongate in concert with the clear.

Suitable examples of paints are those currently used commercially as autobody base coats, e.g., the DurathaneTM Series available from PPG Industries, Inc.

5 The critical requirement of the adhesive layer is to resist damage to the adhesive layer on impact, i.e., the adhesive must:

10 (1) exist in a rubbery state under all use conditions, rather than being glassy in cold weather and soft in warm climates, to maintain gouge or mar resistance, and resist creep or movement, and

15 (2) have sufficient internal strength at all use temperatures (e.g., -30°F to 200°F) to resist penetration by impacting stones and other objects, preventing fracture of the metallic subsurface, thus avoiding electrochemical corrosion.

20 The critical requirements are met by an adhesive having (1) a low T_g , preferably at or below 20°C, more preferably below about -15°C and most preferably at or below about -30°C, and (2) a high tensile modulus, e.g., at least about 260 psi at about 20°C, more preferably at least about 250 psi at about 93°C, even more preferably at least about 500 psi at about 93°C. Preferred adhesives having these characteristics are the aliphatic polyurethane thermoplastic elastomers, e.g., QuinnTM 4820 available from K.J. Quinn Co. Particularly preferred is the aliphatic linear polyurethane elastomer available from Mobay as DesmolacTM 4125.

30 Applications not intended for severe environmental conditions may use adhesives that have only moderate glass transition temperatures and tensile moduli. The adhesive for these applications should have a glass transition temperature below about 20°C and a tensile modulus of at least about 260 psi at 20°C. In addition to the preferred adhesives listed in the preceding paragraph, other suitable adhesives are the polyurethane elastomers PermuthaneTM U-4715, available from Beatrice Chem., Quinn

QI-17, from K.J. Quinn, A.V., and the polyester Bostik 7906, available from Bostik, a division of Emhart Corp.

In addition, the preferred adhesives have the following properties:

- 5 1) high ply adhesion strength to the pigmented base coating;
- 2) high bond strength to the intended application surface;
- 3) resistance during the bonding heat cycle to
10 discoloration that might affect the coloration of the pigmented base coating;
- 4) a tack-free state to allow for wind-up and unwind of the product, and for resistance to pre-adhesion to other objects or the intended application surface;
- 15 5) an activation, i.e., softening, temperature at or above the thermoforming temperature of the composite; and
- 6) retention of its physical properties and bond strength throughout the life of the product.

20

Example 1

 Biaxially oriented polyethylene terephthalate was used as the carrier available from 3M as ScotchparTM Brand Polyester Film. The thickness was 0.004 inches (0.1 mm). The film contained an aluminum silicate additive. The film
25 was of uniformly high gloss and had a controlled caliper.

 A clear lacquer was cast on this carrier, using a conventional bar coater set with a 6 mil orifice. The clear coating used in this Example was melamine modified polyurethane lacquer, identified as HCC-1000 Elastomeric
30 Enamel, sold by PPG Industries, Inc.

 The coated film was pulled through a conventional convention oven, heated at 200°F (93°C) for a short period to evaporate initial solvent, then heated at 250°F (121°C) for approximately 20 minutes. It exited the oven, was
35 allowed to cool, and was wound up on a core.

 HSE-8536 Silver Metallic, a pigmented paint sold by PPG Industries, Inc. under the tradename Durathane 700

Series, was likewise coated on the lacquer side of the above liner, using identical conditions for coating and drying.

5 A polyurethane solution sold by Mobay Chemical Corporation under the tradename DesmolacTM 4125 was lastly coated over the color coating. It was coated using the same device at a 6 mil orifice setting. The adhesive was dried at 250°F (121°C) for a period of approximately 10 minutes, then the coated carrier was wound onto a core.

10 The composite of dried, cured coatings was peeled off the carrier. A piece was cut out, oversize to the intended application, laid down on the part, with the adhesive side making contact, on the platen of a Heat-Vacuum Application Model HVA 2 or 6.

15 A frame was hinge mounted to the platen, having a silicone rubber diaphragm mounted on all four sides. This diaphragm was held off contact at the initial stages of the vacuum draw, so that contact was made initially on the top of the part. The diaphragm then engulfed the part, forcing
20 the paint composite into intimate contact with the part.

Heat lamps mounted above the diaphragm were turned on so that the total application composite heated up to a thermostatically cut off point of approximately 320°F (160°C). The sample was then cooled while under vacuum
25 tension, to prevent contractive forces from disturbing the adhesive bond.

The cooled part was removed and examined. The part had a uniform paint coating adhered to all the critical surfaces and conformed well to the contours,
30 including the corners.

Example 2

The experiment of Example 1 was repeated, making one substitute, the composition of the clear coating. The clear in this Example was formulated from a two part
35 polyurethane.

DesmodurTM N-75 was reacted with a 50/50 blend by solids, of DesmophenTM 670-90 and DesmophenTM 651-A65, at a

NCO-OH ratio of 1.1-1.0. All three components are sold by Mobay Chemical Company.

The finished application was very similar in appearance to what resulted in Example 1.

5

Example 3

Example 1 was repeated, omitting the clear lacquer. The pigmented paint coating was coated directly on the carrier. The resulting base color adhesive composite was stripped after oven drying with similar results.

10

Example 4

Uniaxially oriented polypropylene, SK 500 film, sold by Trea, Inc. was coated with the clear, colored base coating, and adhesive, per Example 1, using the same coater. The SK 500 film had been pretreated with a corona to a dyne/cm level of 37, run according to ASTM-D2578-67.

15

The composite was heated with ceramic elements, and cycled over the part. The part, mounted on a vacuum platen, was forced into contact with the heated film, as a vacuum was drawn to force intimate contact. The source of heat was then cycled to expose the coated part to heated air under pressure to fully form the composite about the part and to activate the adhesive. The part was cooled with compressed air while under vacuum. The carrier film was peeled off, after the pressure was normalized, leaving a three-dimensional part with paint over the intended critical surfaces.

20

25

Example 5

Polycarbonate film, .003" thick, identified as 880-112 by General Electric Corporation, was coated with the same coatings disclosed in Example 1. The composite was applied as in Example 2. The polycarbonate film in this Example was bonded to the coatings and remained a part of the finished part.

30

Examples 6-9

A series of test samples were prepared to compare results obtained when different adhesives were used. The construction of Example 1 was repeated for Examples 6-9, however Example 7 used a polyester adhesive identified as Bostik 7906 from Bostik, a division of Emhart Corp., Example 8 used an acrylic adhesive identified as DuPont 68070 Adhesive, and Example 9 used a tailored terpolymer of isobutyl acrylate, butyl acrylate and acrylic acid in a 65-25-10 weight ratio, having a calculated T_g of 42°C. Example 6 was a repeat of Example 1, using DesmolacTM 4125.

These samples were hot-pressure applied to steel panels, precoated with a primer available from PPG Industries as "Uniprime". The shear creep and 180° peel adhesion tests were conducted with the carrier attached, as it acts as a reinforcing layer which is needed to obtain numerical results in these tests.

Shear creep tests were conducted wherein a 1/2" x 2" strip was cut, with 1/2" x 1/2" adhered to the panel.

A 1000 g weight was attached to the extended tail of the strip and the assembly was placed in ovens of various temperatures. The time for failure was noted when the total strip crept off the panel.

Results:

Time (hours)	Temperature	Ex. 6 (hrs.)	Ex. 7 (hrs.)	Ex. 8 (hrs.)	Ex. 9 (hrs.)
168	79°F	N.F.	N.F.	N.F.	N.F.
168	200°F	N.F.	N.F.	N.F.	N.F.
30	300°F	F-4.4	F-0.1	F-0.75	N.F.-24

(N.F. = No Failure)

(F = Failure)

180° peel adhesion tests were also run on replicates of the above Examples and replicates wherein the

primed steel was replaced with reaction injection molded (RIM) urethane parts available from Mobay Chemical Corp.

	<u>Surface</u>	<u>Adhesion - lb./inch</u>			
		<u>Ex. 6</u>	<u>Ex. 7</u>	<u>Ex. 8</u>	<u>Ex. 9</u>
5	Steel	8.0	0.4	10	0.4
	RIM	4.5	5.5	9	1.0

Finally, Gravelometer tests were run at -20°F, following, the Society of Automotive Engineering J400 Chip Rating Standards (size of chips rated on scale of A-D, A being smallest, D largest and frequency of chips rated on a scale of 9-0, 9 being least frequent, 0 being most frequent). The results were judged to be:

	Ex. 6 - 4A
	Ex. 7 - 6C
15	Ex. 8 - 7C
	Ex. 9 - 4C

The above results show that the high T_g adhesive had excellent resistance to shear creep but the poorest chip rating. The best adhesive, i.e., having optimal properties, was DesmolacTM 4125, an aliphatic linear polyurethane elastomer.

Example 10

HCC 1000 PPG Clear and Canyon Red PPG 700 series automotive paint were sequentially coated with a conventional knife coater, on 4 mil polyethylene-terephthalate film, each coating at a 6 mil bar orifice. Each layer was cured for 5 min. at 250°. DesmolacTM 4125 was then in like manner coated over the paint and cured for 30 min. at 250°.

The above coated film was then cut to size and bonded to Unprimed Steel test panels obtained from Advanced Coating Technologies Inc., using a Hix Press, set at 320-340°F, for a time of 30 seconds.

These painted panels were then subjected to cold metal stamping in the machine shop to introduce 3 corrugations of varying size: the largest corrugation was 1 inch across, 1/4 inch deep, the intermediate was 13/16 inch across and 3/16 inch deep and the smallest was 3/4 inch across and 1/8 inch deep.

(The PET film protects the paint from the stamping oils and general handling abuse. It can be removed at any convenient time after stamping.) When removed, the painted panels had a beautiful coat of paint without noticeable cracks or failures.

Panels that had a coat of the same paint, sprayed on in the normal manner, exhibited cracking at the edges of the largest corrugations.

The above panels were subjected to Gardner Impact testing at room temperature. The post stamped panels resisted the maximum indentation, 160 in-lbs, without failure. The prepainted panel failed at 40 in-lbs.

Similar tests were run, using a Gardner Impact set up in a -20°F cold room. This unit has a maximum capacity of 80 in-lbs, and has a lesser curvature than the other unit. The composite bonded panel passed the maximum, 80 in-lbs without failure. The prepainted panel failed at 25 in-lbs.

What is claimed is:

1. A paint transfer composite comprising:
 - a) a continuous layer comprised of a heat-activatable adhesive having a sufficiently low glass transition temperature and a sufficiently high tensile modulus to resist damage to said adhesive layer on impact, and
 - b) a continuous coating of dry paint on one major face of said adhesive layer.
2. A composite in accordance with claim 1 wherein said adhesive has a glass transition temperature below about 20°C and a tensile modulus of at least about 260 psi at about 20°C.
3. A composition in accordance with claim 2 wherein said adhesive has a glass transition temperature below about -15°C and a tensile modulus of at least 250 psi at 93°C.
4. A composite in accordance with claim 1 wherein said adhesive is an aliphatic polyurethane elastomer.
5. A composite in accordance with claim 1 wherein the activation temperature of said adhesive is greater than about 100°C.
6. A composite in accordance with claim 5 wherein said activation temperature is greater than about 150°C.
7. A composite in accordance with claim 1 wherein said continuous coating of dry paint is comprised of a clear, continuous coating on a dry, pigmented base coating.

8. A composite in accordance with claim 1 further comprising a carrier liner in contact with said layer of dry paint.

9. A composite in accordance with claim 8 wherein said carrier liner is vacuum thermoformable.

10. A method of paint transfer comprising:

- 5 a) mounting a compound structural component in a vacuum chamber having an opening no smaller in area than the surface of said compound structural component to be painted such that said surface of said compound structural component to be painted communicates therewith.
- 10 b) sealing said opening of the vacuum chamber which communicates with said surface of the compound structural component with a paint transfer composite article in accordance with claim 1, in a manner such that said heat-activatable adhesive layer communicates with
- 15 said surface of said compound structural component;
- 20 c) drawing air from said vacuum chamber and exposing said paint transfer composite to heat sufficiently to allow said composite to vacuum-thermoform onto said surface of said compound structural component but insufficient to activate said heat-activatable adhesive layer; and
- 25 d) then exposing said heat-activatable adhesive layer to heat sufficient to activate said heat-activatable adhesive layer; and
- 30 e) allowing said heat-activatable adhesion to cool while maintaining said vacuum used to thermoform said composite until said adhesive layer is cooled below its activation temperature.

11. A method of preparing a paint transfer composite comprising:

- a) coating a carrier liner with a continuous layer of a paint;
- 5 b) drying the paint to form a dry paint coating; and
- c) coating the exposed surface of the paint coating with a continuous layer of a heat-activatable adhesive having a sufficiently low glass transition temperature and a
- 10 sufficiently high tensile modulus to resist damage to said adhesive layer on impact.

12. A method of preparing a painted cold-formed metal compound component comprising applying a composite as defined in claim 1 to a substantially planar metal substrate with the heat-activatable adhesive layer in

5 contact therewith, and cold forming said substrate to the desired compound shape.

13. A cold-formable metal substrate comprising a substantially planar metal substrate, a continuous layer of a heat-activatable adhesive having a sufficiently low glass transition temperature and a sufficiently high tensile

5 modulus to resist damage to said adhesive layer on impact on at least one surface of said metal substrate and a continuous coating of dry paint on the exposed major face of said continuous layer of said heat-activatable adhesive.